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FRMAC Interactions During a Radiological or Nuclear Event

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Disclaimer

FRMAC Interactions During A Radiological or Nuclear Event

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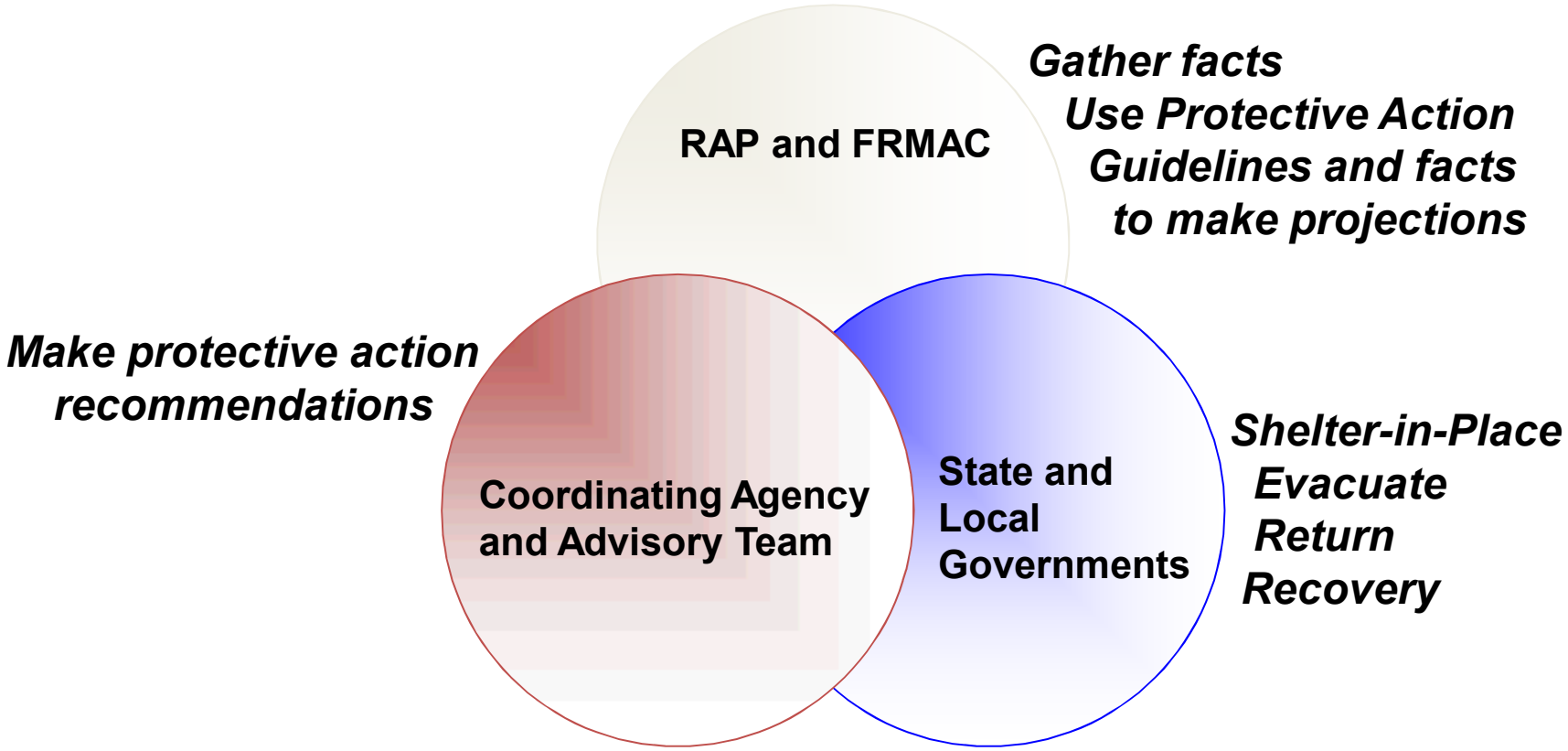
FRMAC Mission Statement

During a radiological or nuclear event of national significance the Federal Radiological Emergency Monitoring and Assessment Center (FRMAC) assists federal, state, tribal, and local authorities by providing timely, high-quality predictions, measurements, analyses and assessments to promote efficient and effective emergency response for protection of the public and the environment from the consequences of such an event.

FRMAC Mission Space

- Domestic nuclear explosion
- Radiological dispersal/ exposure device incident
- Nuclear facility accident or incident
- Nuclear weapons accident or incident
- Transportation accident or incident

Coordinated Radiological Emergency Response



TRIAGE DATA

Radiological Analysis for First Responders

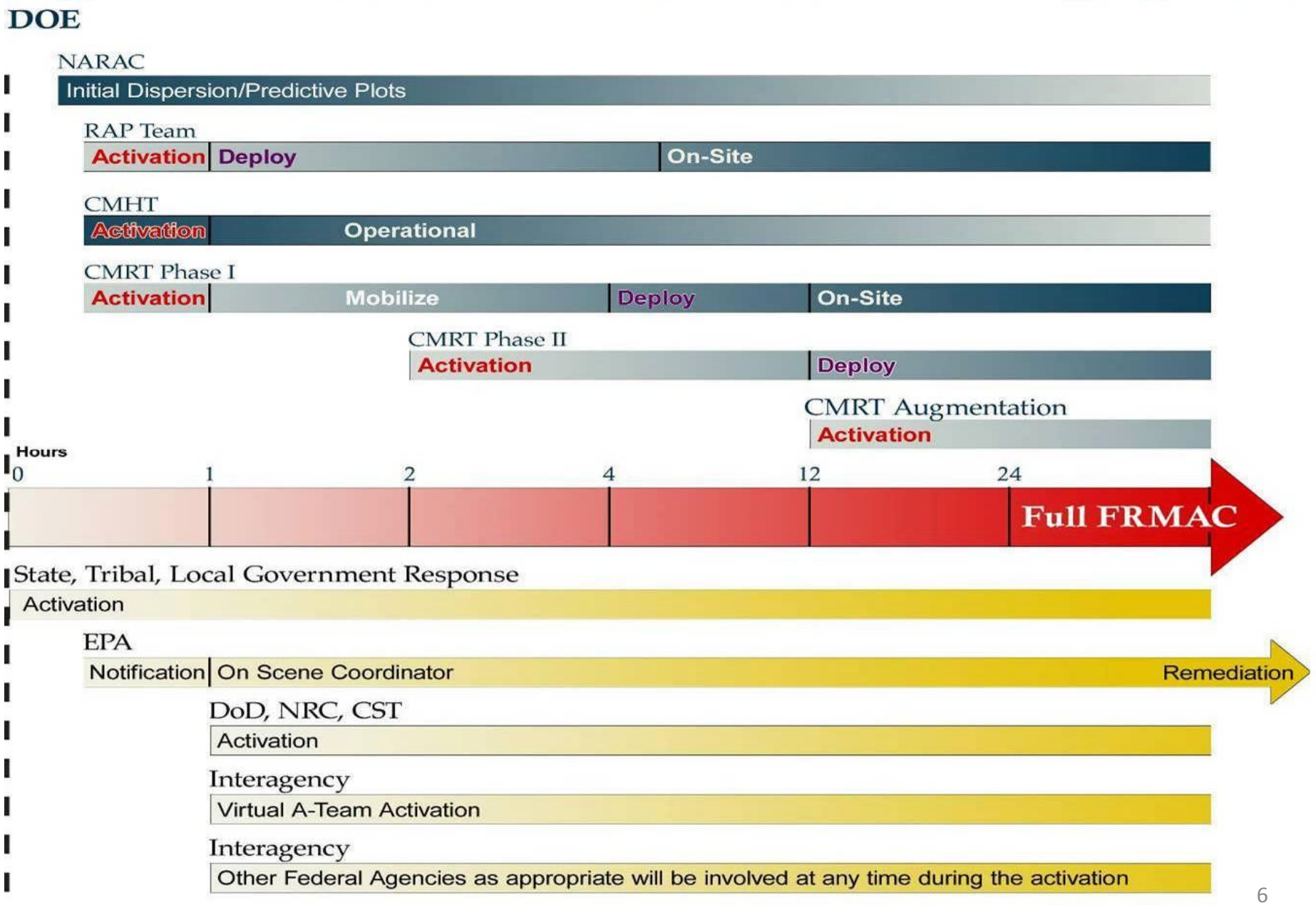
Federal Radiological Monitoring Assessment Center

Emergency Response Assets

Nuclear Incident Team

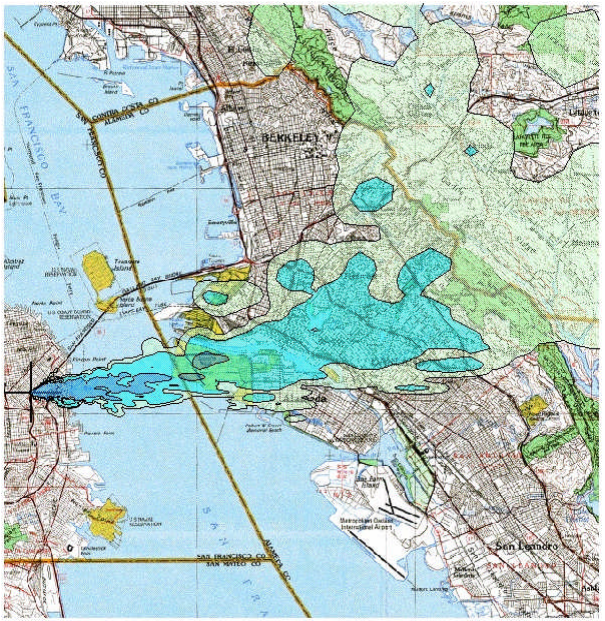
- **FRMAC** — Federal Radiological Monitoring Assessment Center
- **NARAC** — National Atmospheric Release Advisory Center
- **NRAT** — Nuclear/Radiological Advisory Team
- **AMS** — Aerial Measuring System
- **SRT** — Search Response Team
- **REAC/TS** — Radiation Emergency Assistance Center/ Training Site
- **JTOT DISP** — WMD Render Safe Program
  - Joint Technical Operations Team
  - Disposition
- **ARG** — US Weapon Render Safe Program Accident Response Group
- **RAP** — Radiological Assistance Program

Approximate Readiness Time After Activation – Emergency Phase



National Atmospheric Release Advisory Center

- Real-time computer predictions for atmospheric transport and dispersion of radioactive materials
- Computer model calculations based on:
  - Real-time weather data
  - Terrain database
  - 3-D transport and diffusion model
- NARAC products:
  - Ground deposition plots
  - Instantaneous and time-integrated dose
  - Airborne concentrations



RAP and Radiological Search

Capabilities

Provides first response capability to Federal, State, local governments for incidents involving radiological emergencies

First Responders

- 2 to 8 member team
- 220 people located at 28 sites
- 2-hour response time during the day
- 4-hour response time at night
- Approximately 400 lbs of equipment

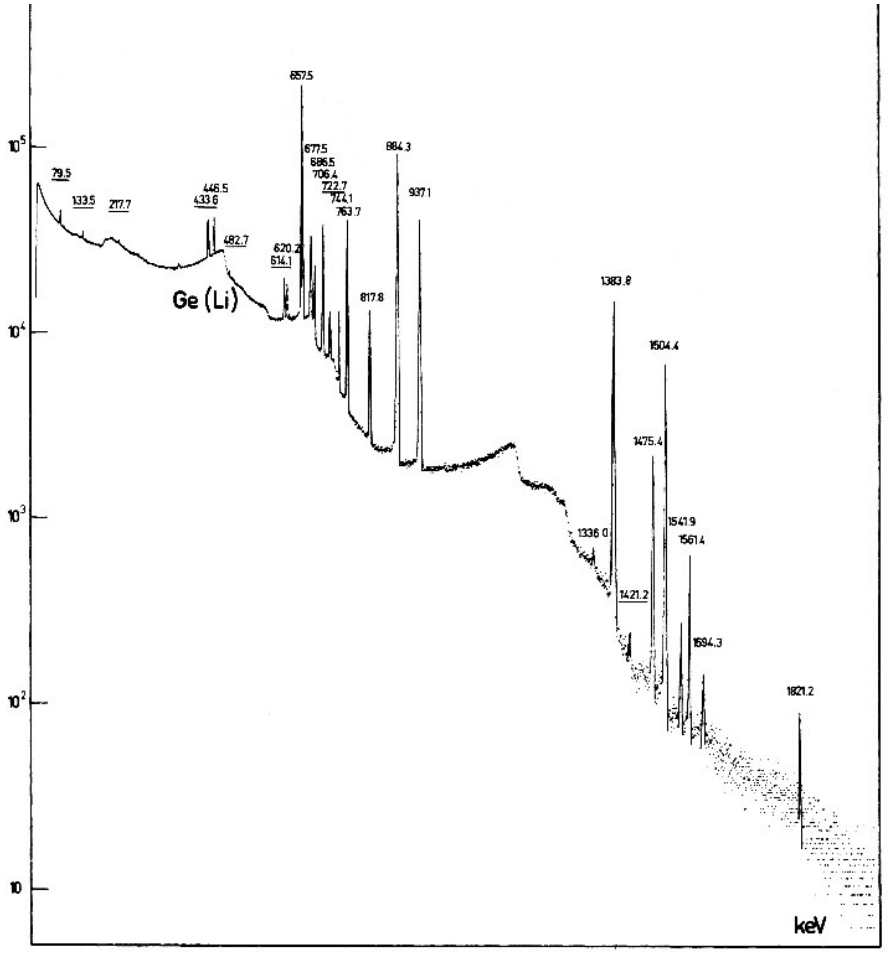
Search for Radiological Material

- Initial Assessment
- Area Monitoring
- Search lost/stolen radioactive material
- Respond to Radioactive lintel threats
- 9-RAP regions

RAP may call upon other DOE assets

Radiological Triage: Radiological Analyses for First Responders

- The DOE Triage System provides rapid scientific evaluation to any responder
- Provides reach-back capability to tap into National Laboratory gamma spectroscopy scientists



Aerial Measuring System

AMS

Capabilities

Provides aviation-based equipment to survey large areas in response to radiological emergencies

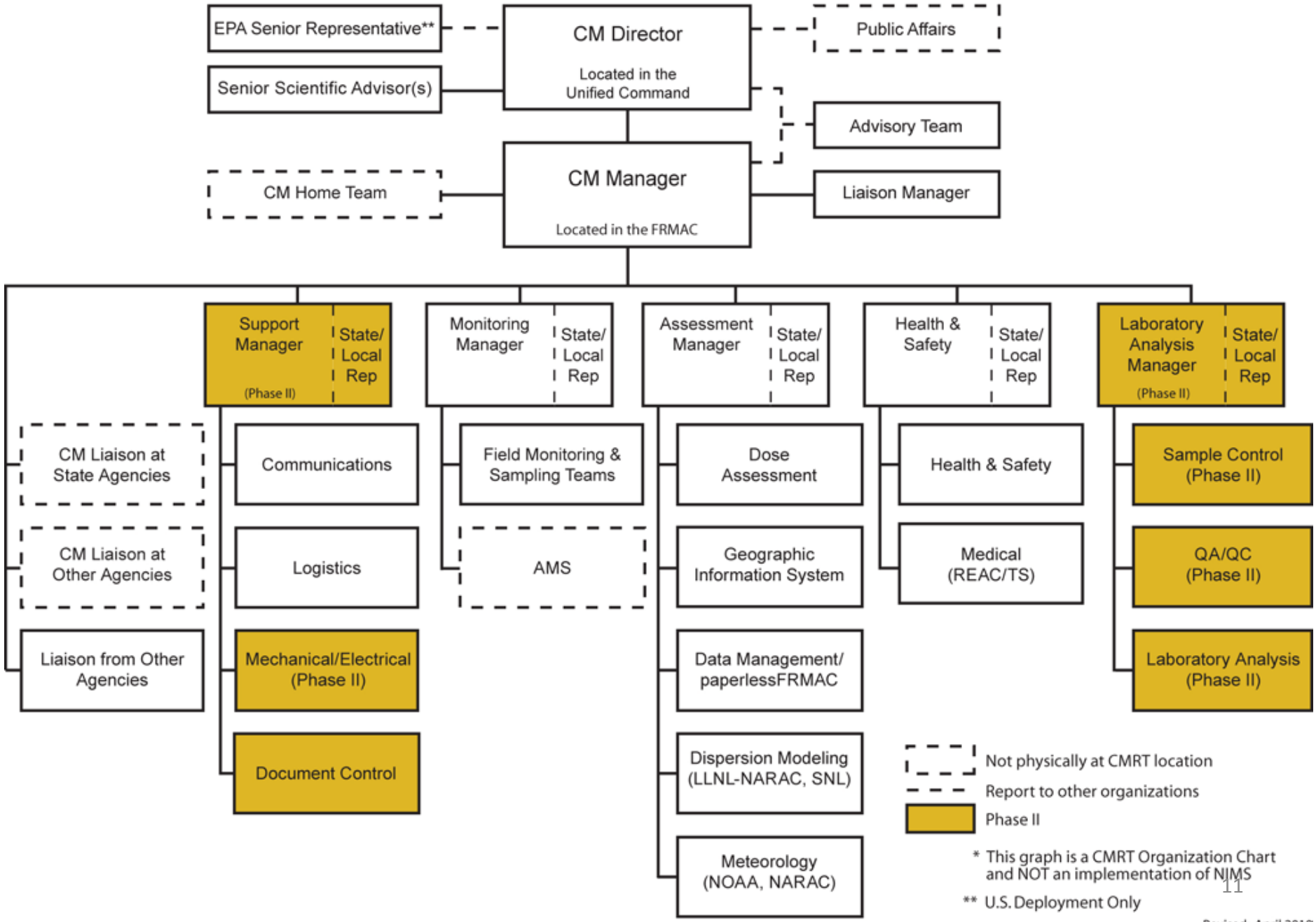
Fixed-Wing Aircraft

- All-weather operation
- Rapid residual fallout pattern
- Cursory radiological data transmitted during flight
  - Peak exposure rates

Helicopter

- Visual flight operation
- Detailed aerial surveys
  - Exposure rate contour maps
  - Dominant isotope gamma spectra
- Data analysis available 1-3 hours after flight completion

CMRT Organization Chart*



CM Home Team

- Bridge Line Coordinators
- GIS Scientist
- Assessment Scientist
  - Position filled by scientists from the National Labs
  - RSL scientist to assist in-house
- NARAC Support Personnel
- pFRMAC Administrator
- Laboratory Analysis

CMHT Capabilities

- CMweb
  - Provides access to maps and data/model products
- RAMS database
  - Allows responders to report field data related to radiation in real time to CMHT
  - Houses all data generated by or received by FRMAC
- Bridge line
  - Monitored conference lines available 24/7 during an event
  - Provides state and local responders with access to assessment scientists and agencies such as EPA, NRC, CDC for guidance
- Laboratory Analysis
  - Primary contact for fixed radiological laboratories
  - Data review and quality control

Advisory Team

- Provides coordinated advice and recommendations on environment, food and health matters to the Federal, state, local and tribal governments.
- Representatives from:
  - EPA
  - CDC
  - FDA
  - USDA
  - Other Federal agencies as needed

CMRT I Capabilities

- Advance Party meeting
- 24-hour per day operations for up to 72 hours
- Limited monitoring, sampling, and in situ
- Assessment
- Health and Safety
- Geographic Information System (GIS)
- Secure communications
- Logistics planning

CMRT II Capabilities

- 24-hour per day operations for several weeks
- Augmented monitoring, sampling, and assessment
- Laboratory Analysis
  - Sample receipt
  - Prepare samples for transport to labs
- Training for additional responders

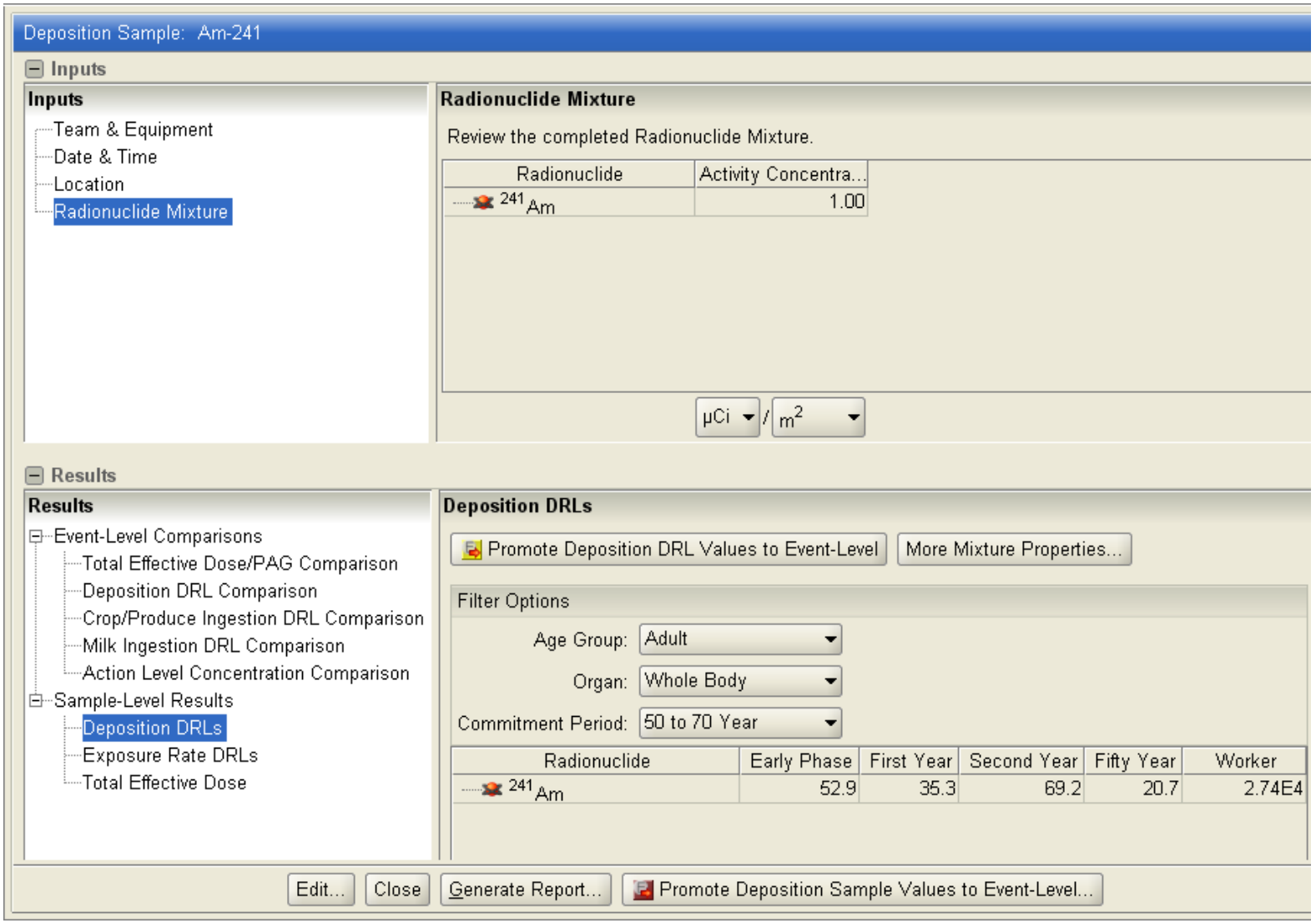
CMRT Augmentation Capabilities

- 24-hour per day operation for several weeks
- Enhanced field analytical capability and capacity
- Fly-Away mobile laboratory

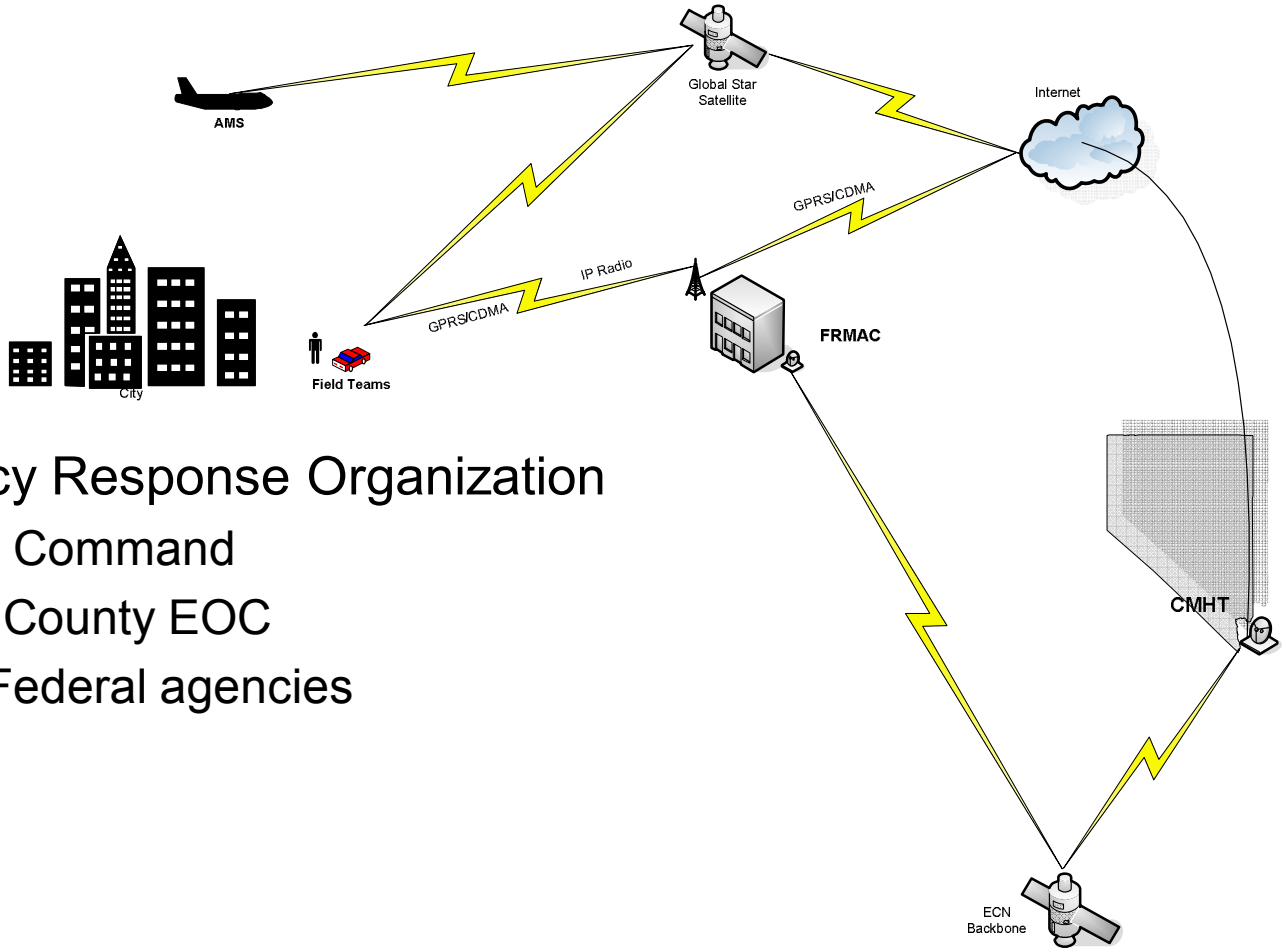
FRMAC – Assessment

- Interpret radiological conditions and provide guidance to responsible government authorities.
  - **Predictive Model Maps** (exposure/dose rate, areal deposition or integrated exposure/dose)
  - **Monitoring/Sampling Maps** (measurements of exposure/dose rate, areal deposition or integrated exposure/dose)
  - **Assessed Data** (field measurements and/or sample analysis results)
  - **Calculation Ana**lysis (DRLs, estimated doses, radionuclide mix, resuspension factor, etc.)
- All radiological predictions and measurements are evaluated in terms of the PAGs.

Turbo FRMAC


Deposition Sample: Am-241
Inputs
Inputs
Team & Equipment
Date & Time
Location
Radionuclide Mixture
Radionuclide Mixture
Review the completed Radionuclide Mixture.
Radionuclide
Activity Concentra...
241Am
1.00
µCi / m2
Results
Results
Event-Level Comparisons
Total Effective Dose/PAG Comparison
Deposition DRL Comparison
Crop/Produce Ingestion DRL Comparison
Milk Ingestion DRL Comparison
Action Level Concentration Comparison
Sample-Level Results
Deposition DRLs
Exposure Rate DRLs
Total Effective Dose
Deposition DRLs
Promote Deposition DRL Values to Event-Level
More Mixture Properties...
Filter Options
Age Group: Adult
Organ: Whole Body
Commitment Period: 50 to 70 Year
Radionuclide
Early Phase
First Year
Second Year
Fifty Year
Worker
241Am
52.9
35.3
69.2
20.7
2.74E4
Edit...
Close
Generate Report...
Promote Deposition Sample Values to Event-Level...

Electronic FRMAC



- Emergency Response Organization
  - Unified Command
  - State / County EOC
  - Other Federal agencies

Data Tablets (MPCD)

Monitoring & Sampling Objectives & Products

- Protect lives and property
- Monitor key infrastructures
- Validate data to support decision-making
- Direct monitoring measurements
- Sampling (field to hotline)
- Electronic Data collection

Field Monitoring Activities and Equipment

Field Sampling Equipment

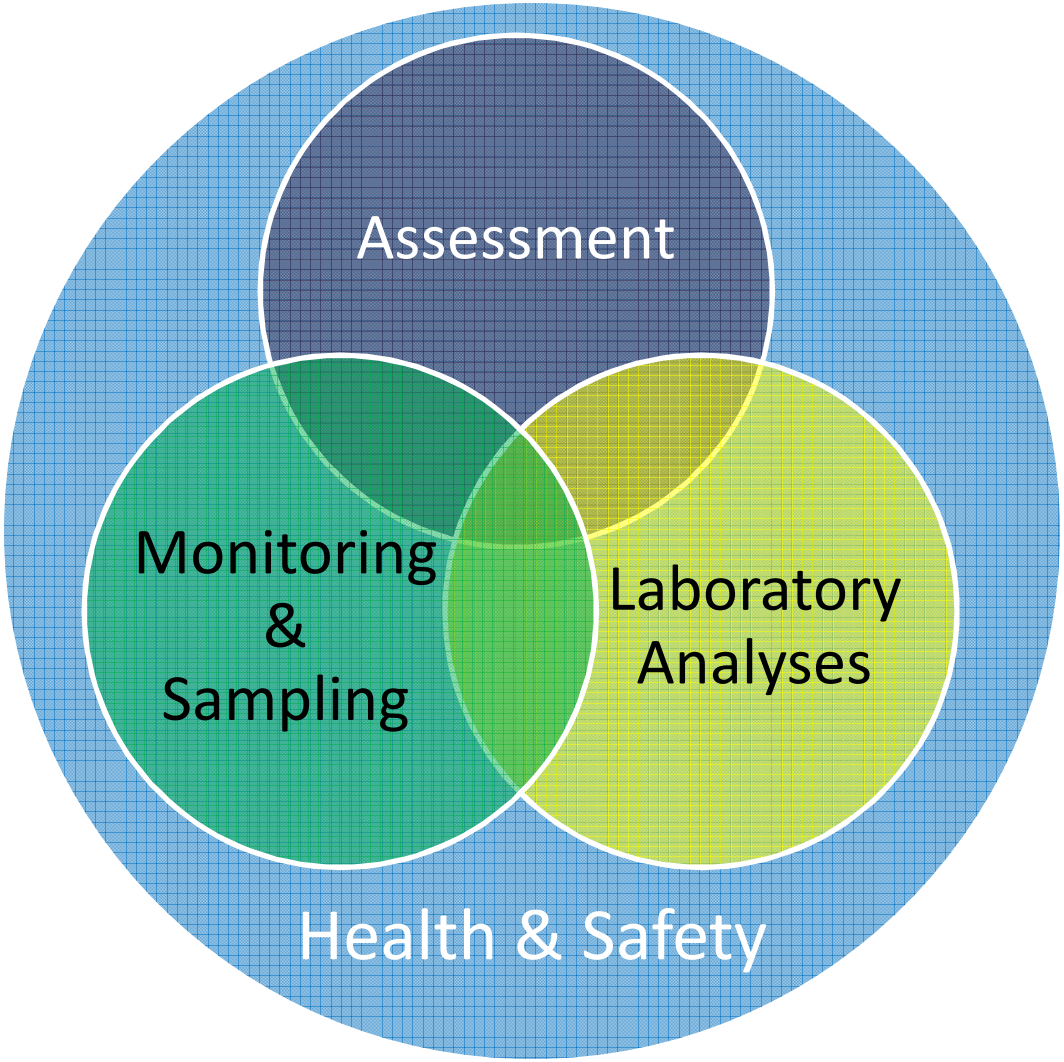
FRMAC – Health & Safety

- Sample Hotline Area
  - Directional signs and areas marked.
  - Periodic contamination surveys conducted.
  - Monitoring to ensure doses are ALARA.
  - Area as “habitable” as possible (chairs, cooling/heating, etc.).
  - Co-located near personnel and equipment hotline (away from FRMAC and labs).

FRMAC – Laboratory Analysis

- Ensure laboratory analyses are performed to support decision making.
- Track samples from drop-off at the Hotline through completion of analyses and disposal.
- “Triage” samples and distribute to laboratories for analyses.
- Verify and validate analytical results.
- Provide rapid laboratory analyses to support decision making.

FRMAC Interactions



Description of Phases

- Early/emergency phase
  - Time of release until release has been controlled
- Intermediate phase
  - Begins after source release has been controlled and continues until protective actions are terminated.
- Late/recovery phase
  - Begins when recovery action designed to reduce radiation levels to acceptable levels for unrestricted use are commenced.

PAGs – Protective Action Guides

- PAG – “committed effective dose equivalent or committed dose equivalent to an individual organ or tissue that warrants protective action following a release of radionuclides”

	Worker	Early Phase	First Year	Second Year	50 Year
Total Effective Dose	1000 mRem	1000 mRem	2000 mRem	500 mRem	5000mRem
Exposure Period	8 hours	4 days (96 hours)	365 days	365 days	50 years

DRLs, AALs, MQOs

- Derived Response Levels (DRLs) are the levels of activity in a sample that if in individual is exposed to for an extended period of time would lead to a dose equivalent to the PAG.
- Analytical Action Levels (AALs) are the activity levels in a sample which are equivalent to the DRLs
- Measurement Quality Objectives (MQOs) are the performance or acceptance criteria provided to the laboratories.

MQOs – Measurement Quality Objectives

- What question are we trying to answer?
- Does a result exceed the AAL?
  - Uncertainty at the AAL is important
- Is a radionuclide present?
  - Detection limit is important
- Not practical to define both the uncertainty at the AAL and the required detection limit.

Default Critical Levels (L_C)

	Air ($\mu Ci/m^3$)	Food ($\mu Ci/kg_{wet}$)	Forage ($\mu Ci/kg_{wet}$)	Milk ($\mu Ci/kg_{wet}$)	ST Soil (μCi/Sample)	LT Soil (μCi/Sample)	Water ($\mu Ci/L$)	Drinking Water (pCi/L)
DRL TYPE APPLIED	**Dp_DRL "Short Term"**	**DIL**	**$Milk\_DRL_{mass}$**	**DIL**	**Dp_DRL "Short Term"**	**Dp_DRL "Long Term"**	**$Milk\_DRL_{water}$**	**EPA guidelines**
Am-241	3.54E-06	5.40E-06	7.20E-02	5.40E-06	3.54E-02	1.00E-03	6.00E-02	Contact FRMAC Assessment for appropriate value
Ba-140	1.79E-05	1.90E-02	7.90E-01	1.90E-02	1.79E-01	1.10E-02	6.60E-01	
Ce-141	2.39E-04	1.90E-02	1.30E+01	1.90E-02	2.39E+00	1.80E-01	1.10E+01	
Ce-144	1.90E-05	1.40E-03	9.40E-01	1.40E-03	1.90E-01	1.30E-02	7.80E-01	
Cf-252	3.73E-06	1.00E-05	1.30E-01	1.00E-05	3.73E-02	1.90E-03	1.10E-01	
Cm-242	7.03E-05	5.10E-05	5.10E-02	5.10E-05	7.03E-01	7.10E-04	4.30E-02	
Cm-244	6.22E-06	5.40E-06	5.40E-03	5.40E-06	6.22E-02	7.50E-05	4.50E-03	
Co-60	1.06E-06	2.00E-03	1.30E-01	2.00E-03	1.06E-02	1.90E-03	1.10E-01	
Cs-134	1.81E-06	2.50E-03	6.30E-03	2.50E-03	1.81E-02	8.80E-05	5.30E-03	
Cs-137	4.20E-06	3.70E-03	9.40E-03	3.70E-03	4.20E-02	1.30E-04	7.80E-03	

Field Measurements vs. Laboratory Analyses

- Rapid determinations
- Non-specific (portable survey meters
  - Unable to identify alpha-emitters and pure betas
- Specific (In-situ gamma spec)
- Large uncertainties
- Not suitable for complex mixtures

- Longer turn-around times
- Positive identification of radionuclides including alpha- and beta-emitters
- Smaller uncertainties
- Suitable for complex mixtures

DOE Fly-away Laboratory

- High Purity Germanium Detectors
- Radon Compensating Alpha/Beta Counters
- Portable Liquid Scintillation Counters

Additional Equipment

Glove Box

Acknowlegements

- Sonoya Shanks
- Alan Remick
- Colleen O’Laughlin